INDOOR AIR QUALITY ASSESSMENT

Department of Children and Families
30 Mystic Street
Arlington, MA

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health
Indoor Air Quality Program
December 2018

Background

Building:	Department of Children and Families (DCF) Arlington Area Office
Address:	30 Mystic Street, Arlington, MA
Assessment Requested by:	Erin McCabe, EHS Facilities Deputy Director for Finance and Operations
Reason for Request:	Concerns about indoor air quality (IAQ) and health
Date of Assessment:	December 17, 2018
Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment:	Ruth Alfasso, Environmental Engineer/Inspector, IAQ Program
Building Description:	Two-story brick building with a flat roof originally built in the late 1950s. The DCF office has occupied this building for approximately 10 years.
Building Population:	Approximately 100 employees of DCF. Members of the public visit daily.
Windows:	Openable

Methods

Please refer to the IAQ Manual for methods, sampling procedures, and interpretation of results (MDPH, 2015).

IAQ Testing Results

The following is a summary of indoor air testing results (Table 1).

- ***Carbon dioxide levels*** were below the MDPH guideline of 800 parts per million (ppm) in all but one area assessed, indicating adequate fresh air for the space.
- ***Temperature*** was within the recommended range of 70°F to 78°F.
- ***Relative humidity*** was below the recommended range of 40% to 60% in all areas assessed the day of the assessment.
- ***Carbon monoxide*** levels were non-detectable (ND) in all indoor areas assessed.

- ***Fine particulate matter (PM2.5)*** concentrations measured were below the National Ambient Air Quality Standard (NAAQS) level of 35 $\mu g/m^3$ in all areas assessed.
- ***Total Volatile Organic Compounds (TVOC)*** were ND in the areas assessed.

Ventilation

A heating, ventilating, and air conditioning (HVAC) system has several functions. First it provides heating and, if equipped, cooling. Second, it is a source of fresh air. Finally, an HVAC system will dilute and remove normally occurring indoor environmental pollutants not only by introducing fresh air, but also by filtering the airstream and ejecting stale air to the outdoors via exhaust ventilation. Even if an HVAC system is operating as designed, point sources of respiratory irritation may exist and cause symptoms in sensitive individuals. The following analysis examines and identifies components of the HVAC system and likely sources of respiratory irritant/allergen exposure from water damage, aerosolized dust, and/or chemicals found in the indoor environment.

Fresh air is provided by air-handling units (AHUs) located on the roof. Operation of the building's HVAC system is controlled by an automated computer system. Air from the AHUs is filtered, heated/cooled, and delivered to rooms via ducted supply vents (Picture 1). Air is returned/exhausted through return vents (Picture 2). It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). It was reported that exhaust vents in the restrooms and kitchen areas vent directly outside. Direct-vented exhaust is recommended in areas where moisture and odors may be generated.

In a few areas, supply vents were blocked with plastic or cardboard (Pictures 3 and 4). Vents should remain unobstructed for proper airflow once the system has been balanced. If there are concerns regarding drafts or noise, building maintenance staff should be contacted for adjustments of the system.

Microbial/Moisture Concerns

Water-damaged ceiling tiles were found in several offices and other areas (Pictures 5 and 6). Some of the water-damaged tiles were near the edge of the building and may be related to leaks through the building envelope. Other water-damaged tiles originate with leaks from the plumbing or HVAC system. Water-damaged tiles should be replaced when the leaks are

repaired. The area above/around the water-damaged tiles should be examined for moisture and odors and remediated as necessary.

Several water coolers and refrigerators were located in carpeted areas (Picture 7). Spills or leaks from these appliances can moisten the carpet, leading to odors and microbial growth. Refrigerators should be kept clean and free of spills and spoiled food that can lead to odors. The large number of small refrigerators presents a challenge in keeping all of them clean (Picture 8).

Plants were present in some areas (Pictures 9 and 10; Table 1). Some of the plants were in poor condition. Plants can be a source of pollen and mold, which can be respiratory irritants to some individuals. Plants should be properly maintained and equipped with drip pans to prevent water damage to porous materials. Plants should also be located away from air diffusers to prevent the aerosolization of dirt, pollen, and mold.

A few trees and plants are located close to the building. Plants can hold moisture against the exterior and prevent drying. Plant roots can also damage the building foundation.

Other IAQ Evaluations

Exposure to low levels of total volatile organic compounds (TVOCs) may produce eye, nose, throat, and/or respiratory irritation in some sensitive individuals. To determine if VOCs were present, BEH/IAQ staff took measurements for TVOCS and examined rooms for products containing VOCs. While no TVOCs above background were detected, BEH/IAQ staff noted dry erase markers, cleaning products, air freshening products and hand sanitizers in use within the building (Picture 11; Table 1). All of these products have the potential to be irritants to the eyes, nose, throat, and respiratory system of sensitive individuals.

Several office areas contained food (Picture 12; Table 1). Food should be stored in tightly-sealed containers to prevent odors and pests, particularly since rodents had been observed in the building. Kitchen equipment such as toasters and microwaves should also be cleaned regularly.

In a few areas, boxes and other items were stored on the floor. Stored items should be placed on shelving to prevent damage from condensation on floors and for ease of cleaning. Note that this assessment was conducted during the agency holiday gift event, and numerous items were being brought into and out of the building as well as stored there to be transported to clients before the holidays, so many of the stored items were temporary during this period.

In many areas, supply and return vents were dusty (Picture 1; Table 1). Personal fans also had dust build-up. These should be cleaned periodically to remove dust which can be reaerosolized and cause irritation. Note that the vent shown in Picture 3 had been covered due to occupant concerns with dust/debris in the office that was attributed to the vent. While no debris was present during the assessment, the occupant reported that dust/debris continues to occur with the vent covered. The occupant should report this dust/debris when it occurs to facility maintenance staff to assist in determining the source, such as disturbed ceiling tiles, plenum pressurization or other issues.

Many offices are carpeted. Carpets should be cleaned annually (or semi-annually in soiled/high traffic areas) in accordance with Institute of Inspection, Cleaning, and Restoration Certification (IICRC) recommendations (IICRC, 2012).

Conclusions/Recommendations

Based on observations at the time of assessment, the following is recommended:

1. Operate supply and return ventilation continuously ("fan on") during occupied periods.
2. Remove obstructions (paper, plastic) from vents. If drafts, noise or other issues are of concern, work with building maintenance staff to resolve.
3. Have occupants report concerns with reoccurring dust/debris to facility maintenance staff to assist in determining the source and resolving the issue. Ensure AHU cabinets are vacuumed out during regular filter changes and ensure no loose/damaged insulation/materials inside unit.
4. Have the HVAC system balanced every 5 years in accordance with SMACNA recommendations (SMACNA, 1994).
5. Change filters for HVAC equipment 2-4 times a year. Use pleated filters of MERV 8 (or higher), which are adequate in filtering out pollen and mold spores (ASHRAE, 2012), if these can be used with current equipment.
6. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is

recommended. Avoid the use of feather dusters. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).

7. Replace water-damaged ceiling tiles. Inspect area above the water-damaged tiles for other water damage or odors and clean or repair as necessary. If water damage continues to occur, identify and repair the leaks.
8. Avoid placing porous items (cloth, boxes) in areas with potential water leaks such as windowsills.
9. Place refrigerators and water dispensing equipment in areas without carpeting or use a waterproof mat underneath them.
10. Ensure all refrigerators are cleaned regularly to remove spoiled food and spills.
11. Keep plants in good condition, avoid overwatering, and avoid placing them on porous materials.
12. Trim back trees and plants adjacent to the building.
13. Reduce use of cleaning products, sanitizers, and scented products.
14. Keep food in tightly sealed containers and keep kitchen equipment clean.
15. Use the principles of Integrated Pest Management (IPM) and the services of a licensed pest control operator to remove rodents and reduce the potential for pest infestation. Ensure that any area where rodents may have been is thoroughly cleaned to remove allergens.
16. Store items in an organized manner and off the floor. Move items periodically to allow for cleaning, including vacuuming and wet wiping of surfaces to remove dust.
17. Clean carpeting in accordance with IICRC recommendations (IICRC, 2012).
18. Clean supply and exhaust vents, personal fans, and heaters regularly to prevent aerosolization of debris.
19. Refer to resource manual and other related IAQ documents located on the MDPH's website for further building-wide evaluations and advice on maintaining public buildings. These documents are available at: http://mass.gov/dph/iaq.

References

ASHRAE. 2012. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 52.2-2012 -- Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI Approved). 2012.

IICRC. 2012. Institute of Inspection, Cleaning and Restoration Certification. Carpet Cleaning: FAQ.

MDPH. 2015. Massachusetts Department of Public Health. Indoor Air Quality Manual: Chapters I-III. Available at: http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/iaq/iaq-manual/.

SMACNA. 1994. HVAC Systems Commissioning Manual. 1st ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

Picture 1

Typical supply vent, note dust on vent

Picture 2

Return vent

Picture 3

Vent blocked with plastic

Picture 4

Vent blocked with cardboard

Picture 5

Water-damaged ceiling tiles next to windows

Picture 6

Water-damaged ceiling tile

Picture 7

Refrigerator on carpet

Picture 8

Refrigerator sign, note items on floor

Picture 9

Plants on windowsill

Picture 10

Plant in poor condition in an office

Picture 11

Cleaners/sanitizers in an office

Picture 12

Food in an office

Location: Department of Children and Families Area Office **Indoor Air Results**

Address: 30 Mystic St., Arlington **Table 1** **Date: 12/17/2018**

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m^3)	TVOCs (ppm)	Occupants in Room	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
Background	439	ND	~32	49	2	ND					Light wintry mix
First floor											
Mark T.	814	ND	70	36	ND	ND	3	Y	Y	Y	
Marc S.	590	ND	71	29	ND	ND	0	Y	Y	Y	Refrigerator, toaster, DO
Kitchen	520	ND	72	28	ND	ND	1	Y	Y	Y	2 refrigerators, plants
Case Records	599	ND	73	27	ND	ND	0	N	Y	Y	Boxes on floor, debris on carpet
Laura A.	554	ND	74	27	ND	ND	0	Y	Y	Y	
Sheila H.	406	ND	74	25	ND	ND	0	Y	Y	Y	Boxes on floor
Reception	530	ND	75	25	ND	ND	1	Y	Y	Y	NC, mailing equipment
Erin B.	514	ND	75	24	1	ND	0	Y	Y	Y	Food, HS, area rug
Anne Marie	524	ND	74	24	ND	ND	0	Y	Y	Y	AT, wall hanging

ppm = parts per million
µg/m^3 = micrograms per cubic meter
ND = non detect
AT = ajar tile
CT = ceiling tile
DEM = dry erase materials
DO = door open
HS = hand sanitizer
AF = air freshener
NC = not carpeted
PF = personal fan
UF = upholstered furniture
WD = water-damaged

Comfort Guidelines

Carbon Dioxide: < 800 = preferable
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

Location: Department of Children and Families Area Office **Indoor Air Results**

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Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m^3)	TVOCs (ppm)	Occupants in Room	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
Dee D.	518	ND	75	24	ND	ND	1	Y	Y	Y	UF, plants, scented product, food
Kate B.	623	ND	75	25	ND	ND	1	Y	Y	Y	Area rug, plants
Kim K.	549	ND	76	23	ND	ND	0	Y 1 open	Y	Y	Plants, HS, items on floor, DEM
Conference	531	ND	76	22	12	ND	2	Y open	Y	Y	DEM, toys on floor
Elizabeth	541	ND	77	23	ND	ND	2	Y	Y	Y	
Judith E.	630	ND	77	23	1	ND	0	Y	Y	Y	Plants
Patricia A.	538	ND	76	23	3	ND	2	Y 2 open	Y	Y	Plants, vent covered, reports of dust on surfaces each morning, vent reportedly loud, very tiny WD on CT
Laura R.	552	ND	76	22	2	ND	0	Y 1 open	Y	Y	Items on windowsill, DEM, HS
Cheryl B.	569	ND	75	21	1	ND	0	Y	Y	Y	HS, toys, plants, DEM
Adriana Z.	577	ND	75	21	ND	ND	0	Y	Y	Y	
Unit outside Mark T.	501	ND	75	22	1	ND	2	N	Y	Y	Refrigerator on carpet

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									Supply	Exhaust	
Unit	657	ND	75	22	1	ND	1	N	Y	Y	Refrigerator on carpet
LEAD unit	567	ND	75	24	3	ND	3	N	Y	Y	Many boxes/toys, DEM
Admin unit	584	ND	76	24	ND	ND	1	N	Y	Y	Small area of WD CT
Unit C ongoing	555	ND	75	22	ND	ND	0	N	Y	Y	
Family Network	611	ND	75	23	1	ND	3	N	Y	Y	DEM, HS
Unit A ongoing	621	ND	76	23	2	ND	4	Y	Y	Y	Refrigerator on carpet, microwave, PF
Response	550	ND	75	22	1	ND	4	Y	Y	Y	WD CT by windows, plants, refrigerator on carpet
Intake B	560	ND	75	24	1	ND	2	N	Y	Y	DEM, refrigerator, HS
Intake A	565	ND	75	23	1	ND	3	Y	Y	Y	DEM, refrigerator, toaster
Liz	575	ND	75	24	2	ND	1	Y 1 open	Y	Y	UF, WD CT – windows, area rug
2nd floor											

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									Supply	Exhaust	
Prom dress storage	614	ND	71	26	ND	ND	0	Y	Y	Y	Prom dresses on hanger racks, slight fabric odor
Legal conference	641	ND	72	25	ND	ND	0	N	Y	Y	WD CT, boxes of records
Debbie (Legal)	760	ND	73	25	ND	ND	1	Y	Y	Y	Heater on, HS, candle
Furniture storage	599	ND	73	24	1	ND	0	N	Y	Y	Old furniture in piles
Shen K.	577	ND	73	24	ND	ND	1	Y	Y	Y	
Lekeisha	650	ND	73	24	ND	ND	0	Y	Y	Y	Plants, WD table
Donna/Bill	552	ND	74	24	ND	ND	0	Y	Y	Y	Paper on floor, plants
Paralegal	558	ND	74	24	ND	ND	0	Y			Dead plant, refrigerator
Records room	589	ND	74	23	ND	ND	0	N	Y	Y	1 WD CT, boxes on floor
Tom (legal)	539	ND	75	23	ND	ND	1	Y	Y	Y	
Marton and Brook	554	ND	76	24	1	ND	2	Y	Y	Y	1 WD CT cardboard on vent in hallway alcove

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									Supply	Exhaust	
Hennigan et. al office	558	ND	75	22	ND	ND	1	Y	Y	Y	Boxes on floor
Files and storage	557	ND	74	24	ND	ND	0	N	Y	Y	Boxes on floor
Bannender et. al.	554	ND	74	23	ND	ND	2	Y	Y	Y	Plants, items on floor, dust/debris on vents
Conference	509	ND	74	23	1	ND	0	N	Y	N	WD CT (a few small areas), NC, AT, all vents appear to be supply vents
Unit J ongoing	523	ND	74	23	2	ND	1	N	Y	Y	Area rug, refrigerator, microwave
Gail H.	522	ND	73	23	1	ND	0	Y	Y	Y	Plants, UF
Michelle E.	507	ND	73	23	ND	ND	0	Y	Y	Y	DEM, cloth on windowsill
Unit A Ongoing	527	ND	73	23	4	ND	1	N	Y	Y	Bean bag chair
Upstairs kitchen	495	ND	73	23	1	ND	0	Y	Y	Y	Also conference room, NC
File room	532	ND	73	23	1	ND	0	N	Y	Y	Boxes on floor, AT
Wellness room	512	ND	73	23	1	ND	0	Y	Y	Y	Wellness room

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									Supply	Exhaust	
Case records	491	ND	72	23	1	ND	0	Y	Y	Y	
Intern	551	ND	71	24	1	ND	1	N	Y	Y	
Dennis	553	ND	71	25	1	ND	1	Y	Y	Y	Refrigerator
File room #3	536	ND	70	24	1	ND	0	Y	Y	Y	Boxes on floor
No name room	540	ND	71	25	1	ND	0	Y	Y	Y	
Unit G ongoing	573	ND	71	26	1	ND	2	N	Y	Y	Refrigerator, HS, items
Redacting room	567	ND	74	26	1	ND	0	Y	Y	Y	UF
Allison	557	ND	74	26	1	ND	1	Y	Y	Y	AF – plug in, DEM, plants
Unit I ongoing	571	ND	74	26	1	ND	2	N	Y	Y	Refrigerator
Unit D ongoing	584	ND	73	25	1	ND	2	Y	Y	Y	Refrigerator and microwave
Carol B.	547	ND	73	25	1	ND	0	N	Y	Y	

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									Supply	Exhaust	
Doublas	569	ND	73	24	ND	ND	2	Y	Y	Y	DEM
Alyse	553	ND	72	25	1	ND	2	Y	Y	Y	DEM
Waiting	554	ND	73	26	3	ND	0	door	Y	Y	
Visit 1	650	ND	73	26	1	ND	0	N	Y	Y	Area rug, WD CT, UF
Visit 2	582	ND	74	25	1	ND	0	N	Y	Y	Area rug
Waiting/ conference	575	ND	75	24	2	ND	0	Y	Y	Y	
Visit 3	673	ND	75	25	2	ND	1	N	Y	Y	

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